axelite 亞瑟萊特科技股份有限公司 AXElite Technology Co.,Ltd

# Single Operational Amplifiers

## ❖ GENERAL DESCRIPTION

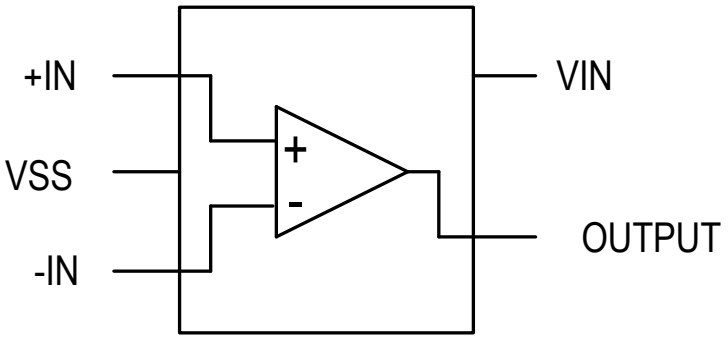
These devices consist of two independent, high gain, internally frequency-compensated operational amplifiers designed operate from a single supply over a wide range of voltages. Operation from split supplies also is possible if the difference between the two supplies is 3V to 36V, and $V_{CC}$ is at least 1.5V more positive than the input common-mode voltage, the low supply-current drain is independent of the magnitude of the power supply voltage.

## ❖ FEATURES

- One internally compensated OP amps
- Wide power supply range: 3V to 36V
- Large output voltage swing: 0V to Vcc-1.5V
- Low input bias current
- Low input offset voltage and offset current
- Internally frequency compensated for unity gain
- Short Circuit Protected Outputs
- Input common-mode voltage range includes ground
- SOT-23-5L and TSOT-23-5L Pb-Free packages

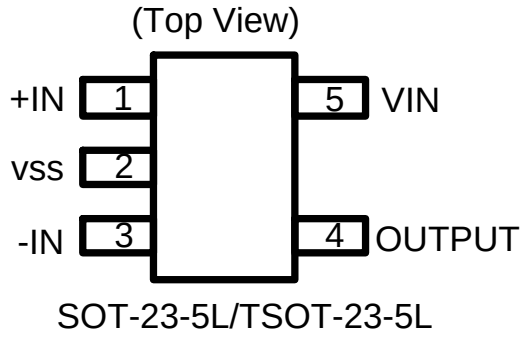


## ❖ BLOCK DIAGRAM



## ❖ PIN ASSIGNMET

The packages of AX321 are SOT-23-5L and TSOT-23-5L; the pin assignment is given by:




| Pin | Description |
|---|---|
| 1 | Non inverting input (+IN) |
| 2 | VSS |
| 3 | Inverting input (-IN) |
| 4 | Output ($V_O$) |
| 5 | VCC |

## ❖ ORDER/MARKING INFORMATION

| Order Information | Top Marking |
|---|---|
| AX321 XX X<br>Package Type<br>B: SOT-23-5L<br>BT: TSOT-23-5L<br>Packing<br>Blank : Bag<br>A : Taping | RDY WX → ID code:internal<br>WW:01~26 (A~Z)<br>27~52 (a~z)<br>Year: A=2010<br>1=2011<br>AX321 |

## ❖ ABSOLUTE MAXIMUM RATINGS (at $T_A$=25°C)

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Power Supply Voltage (Single Supply) | $V_{CC}$ | 40 | V |
| Power Supply Voltage (Split Supplies) | Vcc, Vss | ±20 | V |
| Input Differential Voltage Range | $V_{IDR}$ | ±20 | V |
| Input Common Mode Voltage Range | $V_{ICR}$ | -0.3 to $V_{CC}$ | V |
| Output Short Circuit Duration | $T_{SC}$ | Continuous | |
| Power Dissipation | PD | 500 | mW |
| Storage Temperature Range | $T_{ST}$ | -55 to +165 | °C |
| Operating Junction Temperature | $T_{OPJ}$ | -40 to +125 | °C |
| Junction Temperature Range | TJ | 150 | °C |
| Thermal Resistance from Junction to case | $\theta_{JC}$ | 110 | °C/W |
| Thermal Resistance from Junction to ambient | $\theta_{JA}$ | 250 | °C/W |

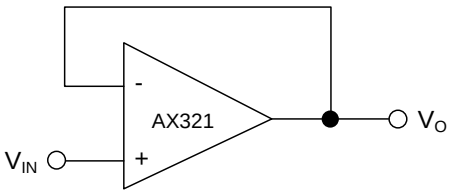
## ❖ ELECTRICAL CHARACTERUSTICS ($V_{CC}$ = 5V, $T_A$=25°C, unless otherwise specified)

| Characteristics | Symbol | Conditions (Note1) | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Input offset voltage**(Note2)** | $V_{IO}$ | $V_{CC}$=5V to Max, $V_{IC}$=$V_{ICR}$ min, $V_O$=1.4V | 1 | 5 | 11 | mV |
| Average temperature coefficient of input offset voltage | $\alpha V_{IO}$ | | - | 7 | - | uV/°C |
| Input offset current | $I_{IO}$ | $V_O$=1.4V | - | 2 | 50 | nA |
| Average temperature coefficient of input offset current | $\alpha I_{IO}$ | | - | 10 | - | pA/°C |
| Input bias current | $I_{IB}$ | $I_{IN}$+ or $I_{IN}$- | - | -20 | -250 | nA |
| Common-mode input voltage range | $V_{ICR}$ | $V_{CC}$=5V to Max | 0 to $V_{CC}$-1.5 | - | - | V |
| High-level output voltage | $V_{OH}$ | $V_{CC}$=Max, $R_L$=2KΩ | 26 | - | - | V |
| | | $V_{CC}$=Max, $R_L$≧10KΩ | 27 | 28 | - | |
| Low-level output voltage | $V_{OL}$ | $R_L$≧10KΩ | - | 5 | 20 | mV |
| Large-signal differential voltage amplification | $A_{VD}$ | $V_{CC}$=15V, $V_O$=1V to 11V, RL≧2KΩ | 25 | 100 | - | V/mV |
| Common-mode rejection ratio | CMRR | $V_{CC}$=5V to Max, $V_{IC}$=$V_{ICR}$ min. | 65 | 80 | - | dB |
| Supply voltage rejection ratio (△$V_{CC}$/△$V_{IO}$) | $K_{SVR}$ | $V_{CC}$=5V to Max | 65 | 100 | - | dB |
| Crosstalk attenuation | $V_{OUT}$ | F=1KHz to 20KHz | - | 120 | - | dB |
| Output current | $I_O$ | $V_{CC}$=15V, $V_{ID}$=1V, $V_O$=0V | -20 | -30 | - | mA |
| | | $V_{CC}$=15V, $V_{ID}$= -1V, $V_O$=2V | 10 | 20 | - | |
| | | $V_{ID}$= -1V, $V_O$=200mV | 12 | 30 | - | uA |
| Short-circuit output current | $I_{OS}$ | $V_{CC}$ =15V, $V_O$=0V | - | 40 | - | mA |
| Supply current | $I_{CC}$ | $V_O$-2.5V, No Load | - | 0.7 | 1.2 | mA |
| | | $V_{CC}$=Max, $V_O$=0.5$V_{CC}$, No Load | - | 1 | 2 | |

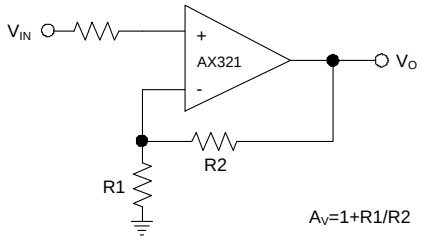
Note1: All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified. “MAX” VCC for testing purposes is 36 V. Full range is 0 °C to 70 °C.
Note2: (VIN+) – (VIN-) > +1mV (min.) for $V_O$=1.4V.

## ❖ APPLICATION CIRCUIT

Volgate Follower

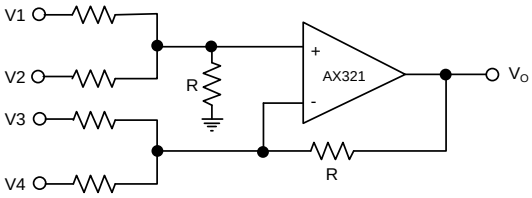



Non Inverting DC Amplifier



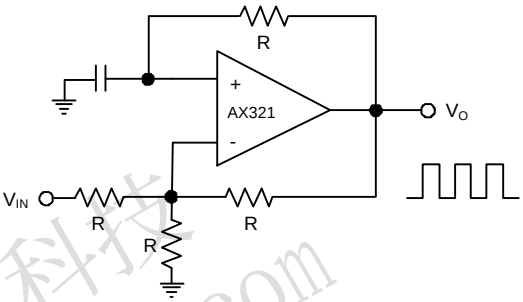

$A_V$=1+R1/R2

DC Summing Amplifier

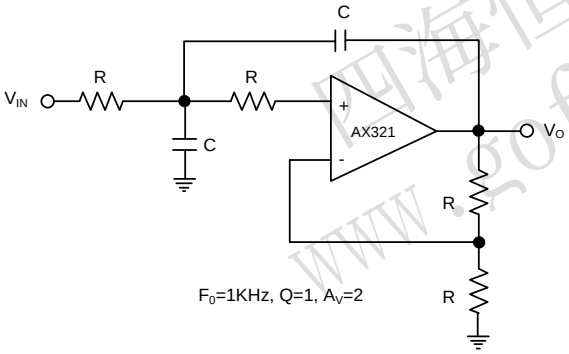



$V_O$=V1+V2-V3-V4
Where (V1+V2)≧(V3+V4)
To Keep $V_O$≧0V

Square-wave Oscillator

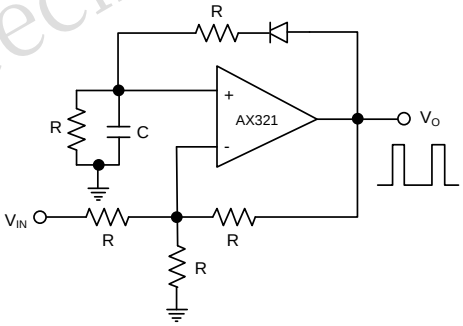



DC Coupled Low-Pass RC Active Filter

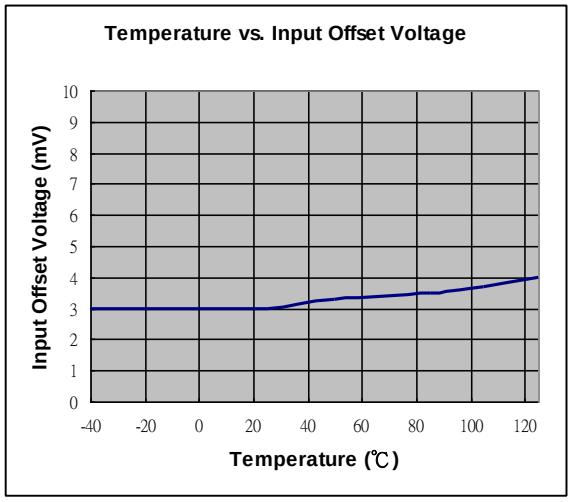


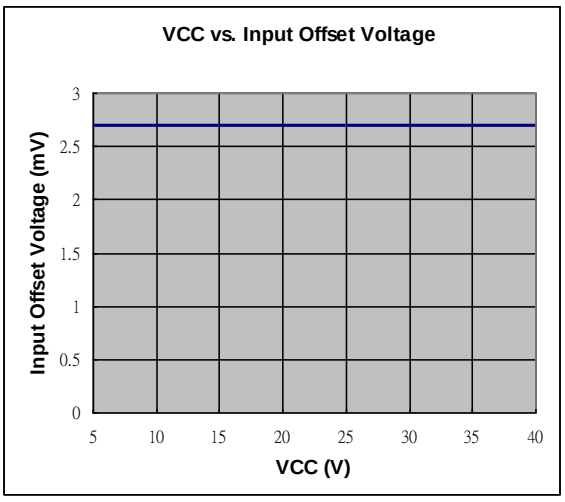

$F_0$=1KHz, Q=1, $A_V$=2

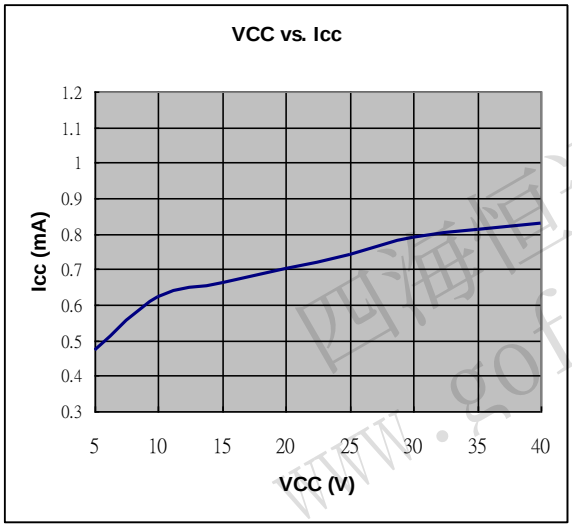
Pulse Generator

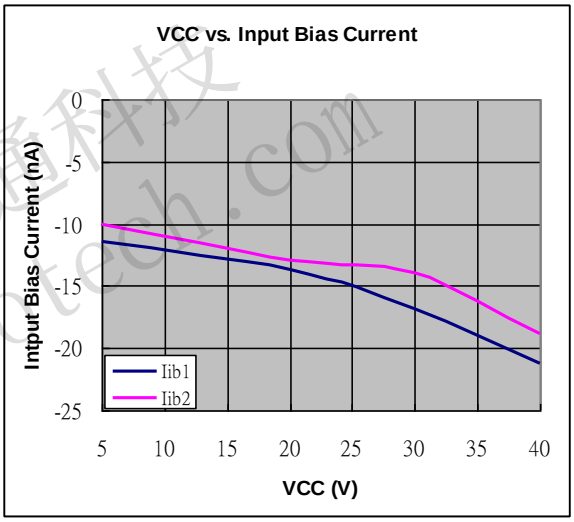


## ❖ TYPICAL CHARACTERISTICS



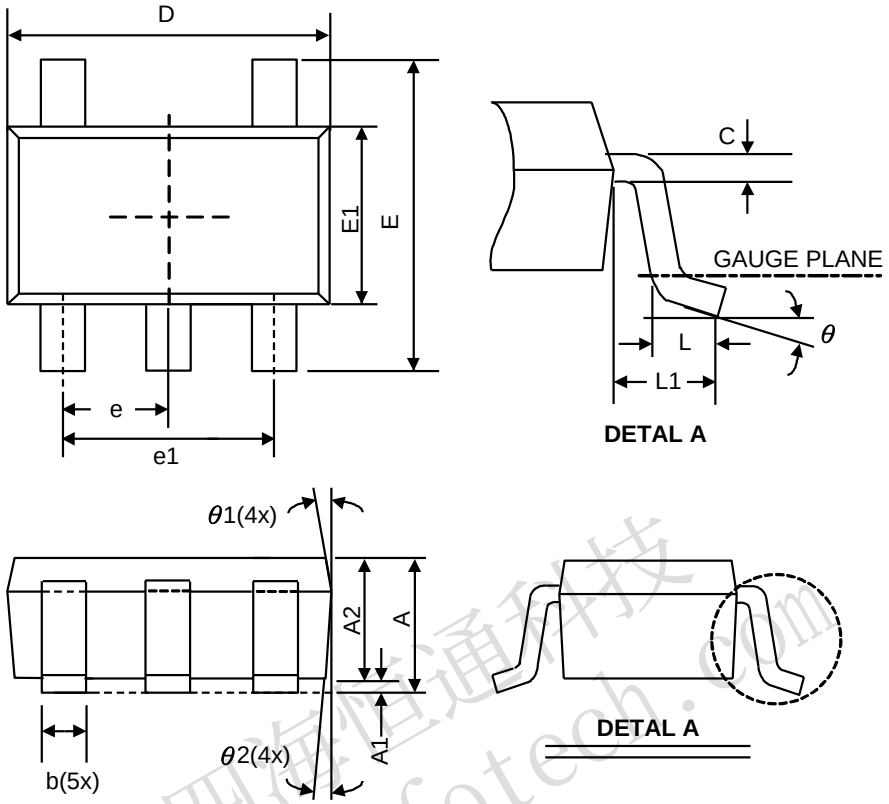



## ❖ PACKAGE OUTLINES

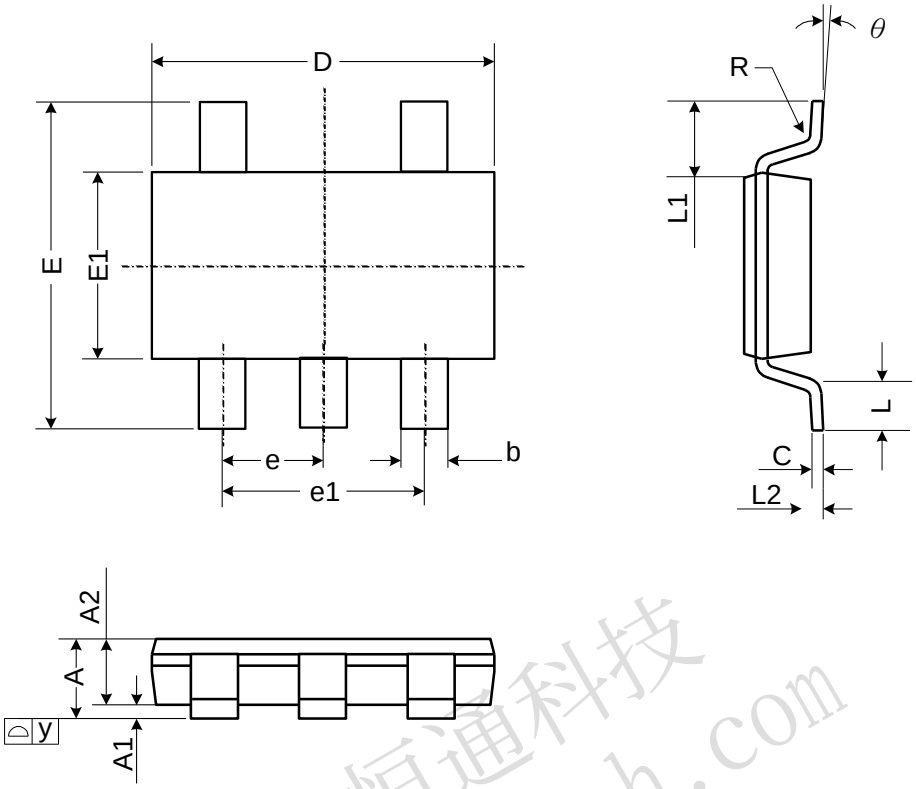
### (1) SOT-23-5L




| Symbol | Dimensions in Millimeters | | | Dimensions in Inches | | |
|---|---|---|---|---|---|---|
| | Min. | Nom. | Max. | Min. | Nom. | Max. |
| A | - | - | 1.45 | - | - | 0.057 |
| A1 | 0.00 | 0.08 | 0.15 | 0 | 0.003 | 0.006 |
| A2 | 0.90 | 1.10 | 1.30 | 0.035 | 0.043 | 0.051 |
| b | 0.30 | 0.40 | 0.50 | 0.012 | 0.016 | 0.020 |
| C | 0.08 | 0.15 | 0.22 | 0.003 | 0.006 | 0.009 |
| D | 2.70 | 2.90 | 3.10 | 0.106 | 0.114 | 0.122 |
| E1 | 1.40 | 1.60 | 1.80 | 0.055 | 0.063 | 0.071 |
| E | 2.60 | 2.80 | 3.00 | 0.102 | 0.110 | 0.118 |
| L | 0.30 | 0.45 | 0.60 | 0.012 | 0.018 | 0.024 |
| L1 | 0.50 | 0.60 | 0.70 | 0.020 | 0.024 | 0.028 |
| e1 | 1.9 BSC | | | 0.075 BSC | | |
| e | 0.95 BSC | | | 0.037 BSC | | |
| θ | 0° | 4° | 8° | 0° | 4° | 8° |
| θ 1 | 5° | 10° | 15° | 5° | 10° | 15° |
| θ 2 | 5° | 10° | 15° | 5° | 10° | 15° |

JEDEC outline: MO-178 AA

## (2) TSOT-23-5L




| Symbol | Dimensions in Millimeters | | | Dimensions in Inches | | |
|---|---|---|---|---|---|---|
| | Min. | Nom. | Max. | Min. | Nom. | Max. |
| A | - | - | 1.10 | - | - | 0.043 |
| A1 | 0.00 | - | 0.10 | 0 | - | 0.004 |
| A2 | 0.70 | 0.90 | 1.00 | 0.028 | 0.035 | 0.039 |
| b | 0.30 | 0.40 | 0.50 | 0.012 | 0.016 | 0.020 |
| C | 0.08 | 0.14 | 0.20 | 0.003 | 0.006 | 0.008 |
| D | 2.80 | 2.90 | 3.00 | 0.110 | 0.114 | 0.118 |
| E | 2.60 | 2.80 | 3.00 | 0.102 | 0.110 | 0.118 |
| E1 | 1.50 | 1.60 | 1.70 | 0.059 | 0.063 | 0.067 |
| e | 0.95 BSC. | | | 0.037 BSC. | | |
| e1 | 1.90 BSC. | | | 0.075 BSC. | | |
| L | 0.30 | 0.45 | 0.60 | 0.012 | 0.018 | 0.024 |
| L1 | 0.60 REF. | | | 0.024 REF. | | |
| L2 | 0.25 BSC. | | | 0.010 BSC. | | |
| y | - | - | 0.10 | - | - | 0.004 |
| R | 0.10 | - | - | 0.004 | - | - |
| θ | 0° | - | 8° | 0° | - | 8° |

JECED outline: MO-193 AB